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ABSTRACT

This study estimated the amount of time required to teach standards at four grade levels (K-2, 3-5, 6-8, and 9-12) as compared to the time available for instruction. Teachers from four districts in Wyoming, Colorado, and North Dakota made three types of judgments regarding each benchmark within a standard: amount of time needed to teach a given benchmark to an average class of students at the grade level they taught, extent to which they agreed that the benchmark was important for students to know or do, and extent to which they agreed that the benchmark was appropriate for students in this grade to know or do prior to or during this grade level. Survey data indicated that an average of 1,100 hours of instructional time were needed at each grade level to address the standards in four domains (language arts, civics, mathematics, and science), which translated to approximately one-and-one-half times the instructional time allotted to teach just the basics in the four domains. Four appendixes contain statistics on participating teachers, survey instruments and forms, data on time estimates for teaching standards in the four domains, and teachers' ratings of importance and appropriateness of benchmarks. (Contains 13 references.) (SM)

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TEACHER SURVEY OF STANDARDS-BASED INSTRUCTION:

ADDRESSING TIME

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Introduction

Throughout the nation, educators and school systems are being held accountable for teaching national, state, or district-level standards in core academic areas (Laboratory Network Program, 1998). The explicit expectations offered by standards are welcomed by many educators, but a concern has been raised that the breadth of content that appears in most standards documents can be overwhelming for instruction. Indeed, when compared with other countries' math and science textbooks, U.S. texts tend to include more topics than is typical internationally (Schmidt, McKnight, & Raizen, 1996). In response to concerns that standards may be asking teachers to cover too much material, this study examines the issue of instructional time needed to teach students all standards in four basic academic domains at four grade levels. This study also assesses ratings of appropriateness of benchmarks at the same four grade levels.

Instruction Time and Standards in U.S. Schools

U.S. schools are on a par with other world-class nations in the overall amount of instructional time available each school year. Though the average number of U.S. school days is much less than the international average (180 vs. 204), the length of the U.S. school day tends to be longer than in many other countries. Thus, an optimistic estimate of instructional time available annually in U.S. schools is approximately 1000 hours, assuming about 5.5 hours or instruction per day. Across the nation, however, there is variance in both the number of days students attend school each year, and the number of hours in a school day.

Not only does available instructional time vary across settings, but individual teachers will use this instructional classroom time differently. In one study of the Chicago Public Schools, researchers observed that out of 900 hours of instructional time available in a year, nearly half of the teachers used

the classroom time effectively by spending 20% or less of their time on non-instructional activities, leaving them with between 720 and 900 hours available for instruction. Unfortunately, the other half of the teachers used 30% of classroom time for non-instructional purposes on average, leaving them with a total of 630 hours available for instruction (Smith, 1998).

An issue related to how teachers use instructional time is how well they pace new materials. One study found that when instruction slows down (that is, less new material is covered in later grades), it is due in part to review and repetition of material by teachers (Consortium on Chicago School Research, 1998). Thus, even for a fixed amount of instruction time, the pacing of instruction can vary.

A majority of the public agrees that standards documents are useful and important. Teachers and administrators are generally supportive of content standards and assessment systems because they realize that standards and accountability provide the backdrop for high quality, equitable education. (Schmoker & Marzano, 1999). Explicit standards have provided teachers with the focus of instruction that had been lacking. Standards set by grade level can further prevent repeated presentation of material to students that has often occurred in the past. Despite these potential advantages it is teachers who are given the responsibility of instructing students to the point of mastering content and performance standards, often with little pedagogical support from colleagues or supervisors.

Purpose of Study

The purpose of this study is to estimate of the amount of time required to teach standards at four specific grade levels as it compares to the time available for instruction. An assumption made by this study is that current teachers have adequate knowledge of and experience with standards-based instruction to estimate the amount of classroom time needed to instruct students in specific content and skills. Additional data collected includes teachers' judgments of the importance and appropriateness of

content standards for their instructional grade level. These judgement ratings of generally accepted standards provide some insight into teachers' beliefs about what knowledge should be presented to students in specific grades.

Methods

Participants

Teachers from four school districts located in Colorado (1), Wyoming (2), and North Dakota (1) were surveyed for this study. Teachers were recruited from school districts with which McREL had a working relationship, though only teachers of the appropriate grade levels (second and fifth grade, middle school, and high school) wishing to participate in the study did so. Demographic characteristics of the teachers, by grade level, and the schools in which they work can be found in Appendix A. In general, approximately one-third of these teachers were from each of rural (29%), suburban (29%), and urban (42%) school settings. Teachers work in settings that average 24 students in a class. Overall student achievement level in the school was rated as above average (32%), average (52%), or below average (16%) by respondents.

These teachers are not necessarily representative of all American teachers. While all of these teachers are involved in implementing standards-based education systems, these three central states vary in their practices of assessing student achievement on previously adopted standards. The Colorado district began implementing an outcomes based education system over a decade ago. One Wyoming district, on the other hand, is currently just beginning to fully implement a standards-based system with the state's new accountability system providing the backbone for the change.

The distribution of survey respondents across the various grade levels and content areas examined is shown in Table 1. Each teacher was paid $25.00 for returning a completed survey, and surveys required an estimated 30 to 45 minutes to complete.

Table 1
Distribution of Survey Respondents Across Grade Levels and Content Areas

Grade Levels	Number of Teachers	Number of Standards (Benchmarks) Reviewed	Academic Area
K-2	27	40(126)	Language Arts Civics Mathematics Science
3-5	30	25(133)	Language Arts Civics
	24	25(127)	Mathematics Science
6-8	9	8(74)	Language Arts
	5	26(147)	Civics
	14	9(69)	Mathematics
	12	16(89)	Science
9-12	35	8(81)	Language Arts
	14	29(179)	Civics
	17	9(73)	Mathematics
	21	16(89)	Science

Materials

The standards and benchmarks that comprised the questionnaires were taken from the McREL compendium of standards (Kendall & Marzano, 1997), a standards resource constructed as a synthesis of 116 standards documents covering 14 different academic domains.

Table 1 also shows that teachers completed a questionnaire of standards and benchmarks for one of the following grade spans: K-2 (second grade teachers were surveyed), 3-5 (fifth grade teachers), 6-8 (middle schools teachers), or 9-12 (high school teachers). Each group of teachers examined standards and benchmarks in one or more of four academic domains: Language Arts, Civics, Mathematics, and Science. These domains were selected because they include the basics of reading, writing, and mathematics, along with other content areas that the general public believes to be important for children to learn in school (Marzano, Kendall, & Cicchinelli, 1999).

Teachers were instructed to make three types of judgments regarding each benchmark within a standard. First, teachers estimated the amount of *time* in hours it would take to teach a given benchmark to an average class of students at the grade level they teach. Second, teachers indicated to what extent they agreed that the benchmark is *important* for students to know/do. Third, teachers indicated to what extent they agree that the benchmark is *appropriate* for students in this grade to know/do prior to or during this grade level. "Importance" and "appropriateness" were measured using a four point scale ranging from "strongly agree" to "strongly disagree." The instructions received by teachers and a portion of a survey appear in Appendix B.

Analysis

Participants' estimates of time to teach benchmarks within a standard for a specified grade range were summed to achieve an overall estimate of instruction time for the standard. For each standard, extreme outlying estimates of time were omitted from analysis (i.e., those more than three standard deviations from the average rating), and the median estimate was used as a conservative estimate (i.e., the median was consistently a smaller estimate than the mean) of time required to teach a standard. Next, these estimates of teaching time for standards within an academic domain were summed to arrive at an estimate of instruction time for the entire content domain.

Results

The overall estimates of instruction time by grade and academic domain are shown in Table 2. These results suggest that an average of 1100 hours of instructional time are needed at each grade level to address the standards in these four domains alone. Appendix C contains the estimates of instruction time needed for each standard in each of the four academic domains by grade. Also shown in Appendix C is the average time required to teach a benchmark associated with a given standard.

These time estimates suggest a possible mismatch between expectations for educational instruction and available time. Using the Chicago Public Schools study, there are 630 to 720 hours available in a school year. Similarly Perie, Baker, & Bobbitt, (1997) found that elementary level teachers estimate spending 68% of available classroom time on instruction, or 680 hours in the average American school which has 1000 hours of classroom time. Thus, there clearly is not enough classroom time available for teaching all of the standards in these four domains, let alone a district's entire curriculum for a grade level. These results underscore the importance of providing teachers with explicit curricular expectations in the form of standards for specific grade levels, so that important

content is not repeated or omitted. These results also highlight the importance of enhancing pedagogical and classroom management abilities of teachers.

Table 2.
Total estimates of instructional time needed, in hours, to teach standards in the four domains

Academic Domain	Grade Level			
	2nd Grade	5th Grade	8th Grade	12th Grade
Language Arts	447	433	608	258
Civics	37	201	273	346
Mathematics	245	289	281	309
Science	90	129	260	215
Total	819	1052	1422	1128

Teachers' Evaluation of Benchmarks

In light of the results shown in Table 2, which suggest that teachers do not have enough instructional time to teach all standards and benchmarks, it can be hypothesized that teachers are either giving less than the needed time to each standard or they may be omitting from instruction those standards or benchmarks they deem less important or less appropriate to their grade of instruction. The survey assessed teachers' judgments of importance and appropriateness of teaching each of the benchmarks encompassed by the four academic domains at the designated grade level. Omitting from instruction a benchmark that is judged less important by an individual teacher (but was judged important by the standards community) probably reflects a compromise made for lack of time. Omitting a benchmark judged not appropriate may be for the same reason or may be compounded by low teacher expectations. Further research is needed to explore actual teaching practice.

Table 3 presents the benchmarks rated most important and least important by second grade teachers across all four domains. Benchmarks were rated on a scale of 1 to 4 from strongly disagree, disagree, agree, to strongly agree. A mean ratio less than 3 suggests on average teachers do not agree that the benchmark is important. Table 4 presents the benchmarks rated most appropriate by second grade teachers across all four domains. Without additional information from teachers and observations or logs of time spent on benchmarks, generalizations or conclusions can not be drawn from these ratings about actual teaching practice. The discrepancy between what the larger educational community believes is appropriate and what teachers believe is an important area for further research. Appendix D contains similar results for the other three grade levels surveyed, for each of the four academic domains.

The use of teachers' judgments of the value of benchmarks to guide the focus of classroom instruction can be a problem, however, if the assessment program is not aligned with teachers' opinions. That is, if a state assessment program tests students on all standards and benchmarks, including those generally considered less important by teachers for a specific grade level, then students and teachers may be penalized for not learning when in fact, the material, has not been taught.

Table 3.
Second Grade Importance of Benchmark Ratings (N=27).
Highest and Lowest Rated Benchmarks

Rank	Highest Rated Benchmarks	Average Rating
1	Uses complete sentences in written compositions (Language Arts Standard 3, Benchmark B)	3.92
2	Forms letters in print and spaces words and sentences (Language Arts Standard 3, Benchmark A)	3.89
2	Follows rules of conversation (e.g., takes turns, raises hand to speak, stays on topic, focuses attention on speaker) (Language Arts Standard 8, Benchmark D)	3.89
2	Decodes unknown words using basic elements of phonetic analysis (e.g., common letter/sound relationships) and structural analysis (e.g., syllables, basic prefixes, suffixes, root words) (Language Arts Standard 5, Benchmark E)	3.89
2	Uses conventions of capitalization in written compositions (e.g., first and last names, first word of a sentence) (Language Arts Standard 3, Benchmark I)	3.89
	Lowest Rated Benchmarks	
1	Knows that distributive justice refers to problems of fairness arising over "who gets what" based on the criteria of need, ability, and desert; and knows examples of situations that involve distributive justice (e.g., how much food should different members of a family receive at dinner time) (Civics Standard 3, Benchmark C)	2.19
2	Knows that procedural justice refers to problems arising over fair ways to gather information and make just decisions, and knows examples of situations involving procedural justice (e.g., how should a class president go about deciding which games the class will play) (Civics Standard 3, Benchmark E)	2.27
3	Knows that a good leader puts the interests of the people ahead of personal interests (Civics Standard 29, Benchmark A)	2.48
4	Knows that the consequences of privacy can be both beneficial and costly (Civics Standard 26, Benchmark A)	2.50
5	Knows that people in positions of authority have limits on their authority (e.g., a crossing guard cannot act as an umpire at a baseball game (Civics Standard 2, Benchmark A)	2.60

Table 4.
Second Grade Appropriateness of Benchmark Ratings (N=27).
Highest and Lowest Rated Benchmarks

Rank	Benchmark	Average Rating
	Highest Rated Benchmarks (2nd grade)	
1	Listens and responds to oral directions (Language Arts Standard 8, Benchmark F)	3.93
2	Decodes unknown words using basic elements of phonetic analysis (e.g., common letter/sound relationships) and structural analysis (e.g., syllables, basic prefixes, suffixes, root words) (Language Arts Standard 5, Benchmark E)	3.93
3	Understands basic whole number relationships (e.g., 4 is less than 10, 30 is 3 tens) (Mathematics Standard 2, Benchmark D)	3.93
4	Uses complete sentences in written compositions (Language Arts Standard 3, Benchmark B)	3.92
5	Applies reading skills and strategies to a variety of familiar literary passages and texts (e.g., fairy tales, folktales, fiction, nonfiction, legends, fables, myths, poems, picture books, predictable books) (Language Arts Standard 6, Benchmark A)	3.92
5	Adds and subtracts whole numbers (Mathematics Standard 3, Benchmark A)	3.92
	Lowest Rated Benchmarks (2nd grade)	
1	Knows that distributive justice refers to problems of fairness arising over "who gets what" based on the criteria of need, ability, and desert; and knows examples of situations that involve distributive justice (e.g., how much food should different members of a family receive at dinner time) (Civics Standard 3, Benchmark C)	2.24
2	Knows that procedural justice refers to problems arising over fair ways to gather information and make just decisions, and knows examples of situations involving procedural justice (e.g., how should a class president go about deciding which games the class will play) (Civics Standard 3, Benchmark E)	2.36
3	Knows that a good leader puts the interests of the people ahead of personal interests (Civics Standard 29, Benchmark A)	2.48
4	Knows that people in positions of authority have limits on their authority (e.g., a crossing guard cannot act as an umpire at a baseball game) (Civics Standard 2, Benchmark A)	2.67
5	Knows that characteristics of a good leader (e.g., experience, determination, confidence, a desire to be a leader, the ability to solve problems creatively) (Civics Standard 29, Benchmark B)	2.70

Conclusions

Available instructional time for teachers is a major issue in standards-based reform. Teachers need time to master new standards, to plan instruction focused on standards, and adequately teach and assess the standards. As this survey's results show, teachers estimate that they need approximately one-and-one-half times the instructional time allotted to teach just the basics of language arts, mathematics, science and civics, not to mention the other social sciences, technology, foreign languages, and the arts.

In one sense, standards-based instruction should alleviate some of the time pressure experienced by teachers because the expectations of students within each grade level are made explicit through standards documents. As a result, teachers are aware of what needs to be covered in the classroom and achieved by students within the school year.

Whether these explicit expectations are manageable for teachers is not empirically assessed when developing standards, although teachers are often a part of this development process. This study's finding that standards-based instruction requires more than the available classroom time suggests that teachers make choices about which standards and benchmarks to teach. Additionally, teachers appear to be able to make judgments about what content is important and which is appropriate for teaching at specific grade levels, based on their experience.

In addition, the importance of teachers' effective use of available instructional time is underscored by the finding that standards-based instruction takes much more time than is available. Indeed, some research finds that adding academic time to classrooms where time is not well utilized does not produce gains in student achievement (reported in Aronson, Zimmerman, & Carlos, 1999).

In particular, when working with at-risk populations, for whom needed instructional time is even longer, time management is vital (Aronson, Zimmerman, & Carlos, 1999). After-school programs have been used to address the problem of needing additional instructional time to support achievement of all students (Policy Studies Associates, Inc., 1995).

Another issue these results raise is the structure of the school day and year. It might be advantageous for states to consider adding days to the school year, and providing teachers with more planning time within each day or week, as is done in other countries. Also, a three month summer contributes to teachers' practice of reviewing material, a practice which uses up valuable classroom time. A year round school year schedule counteracts some of the learning loss that occurs over the summer (Ballinger, 1993; Worthen & Zsiray, 1994). Looping teachers with students for more than one grade level is another change that teachers report reduces the need for time to acquaint teachers with students' skill levels.

Finally, as noted earlier, one assumption made by this study is that teacher estimates of the amount of classroom time required to instruct students in the standards and benchmarks is accurate and independent. This assumption may not be valid for a number of reasons. For one, interdisciplinary instruction – within and across multiple domains -- may reduce the instruction time required for any one skill. For example, students' writing improves with their constructing science and social studies reports, and from what is learned in reading. Secondly, if teachers are not experienced in understanding and teaching specific benchmarks they will not be able to accurately estimate instruction time. Nonetheless, teachers are an important and valuable source for information regarding time and standards-based instruction. The educators surveyed in this study had an average of 18.4 years of teaching experience,

and therefore much knowledge to draw on in making their judgments. Additionally, teacher responses support the hypothesis that available time for instruction is not adequate, although these estimates were not as extreme as originally expected.

References

Aronson, J., Zimmerman, J. & Carlos, L. (1999). *Improving student achievement by extending school: Is it just a matter of time?* San Francisco, CA: WestEd.

Ballinger (1993). Year-round education: It's time. In L. Anderson & H.J. Walberg, eds. *Timepiece: Extending and enhancing learning time.* Reston, VA: National Association of Secondary School Principals.

Consortium of Chicago School Research (1998). *Setting the pace: Opportunities to learn in Chicago's elementary schools.* Chicago, IL: Consortium of Chicago School Research.

Education Week (1999). Quality counts: Rewarding results, punishing failure. *Education Week*, 18(17).

Kendall, J.S., & Marzano, R.J. (1997). *Content Knowledge: A compendium of standards and benchmarks for K-12 Education* (2nd ed.). Aurora, CO: Mid-continent Regional Educational Laboratory.

Laboratory Network Program (1998). *Taking stock of states' curriculum-based reform efforts: An interim report of the Laboratory Network Program's Curriculum, Learning, and Instruction Project.* Aurora, CO: Mid-continent Regional Educational Laboratory.

Marzano, R.J., Kendall, J.S., & Cicchinelli, L.F. (1999). *What Americans believe students should know: A survey of U.S. adults.* Aurora, CO: Mid-continent Regional Educational Laboratory.

Petie, M., Baker, D.P., & Bobbitt, S. (1997). *Time spent teaching core academic subjects in elementary schools: Comparisons across community, school, teacher, and student characteristics*. Washington, D.C.: National Center for Education Statistics.

Policy Studies Associates, Inc. (1995). *Extending the learning time for disadvantaged students: An idea book. Vol. 2, Profiles of promising practices*. Washington, DC: U.S. Department of Education.

Schmidt, W.H., McKnight, C.C., & Raizen, S.A. (1996). *Splintered vision: An investigation of U.S. science and mathematics education: Executive summary*. Lansing, MI: U.S. National Research Center for the Third International Mathematics and Science Study, Michigan State University.

Schmoker, M & Marzano, R. (1999). Realizing the promises of standards-based education. *Educational Leadership*, V. 56(6).

Smith, B. (1998). *It's about time: Opportunities to learn in Chicago's elementary schools*. Chicago, IL: Consortium on Chicago School Research.

Worthen, B.R., & Zsiray, Jr., S.W. (1994). What twenty years of educational studies reveal about year-round education. Raleigh, N.C.: North Carolina Educational Policy Research Center, Chapel Hill.

Appendix A

Descriptive Statistics of Participating Teachers

School or Teacher Factor	2nd Grade Teachers (N=27)	5th Grade Teachers (N=54)	Middle School Teachers (N=40)	High School Teachers (N=87)
Percentage teachers in school setting:				
Urban	42%	38%	38%	49%
Suburban	33%	33%	20%	31%
Rural	25%	29%	41%	20%
Median classroom size at school	22	24	25	25
Median School Enrollment (Range)	385 (100-728)	330 (170-810)	350 (156-1200)	1200 (45-8000)
Percentage from schools with overall student achievement level:				
Above Average	30%	27%	28%	43%
Average	44%	59%	62%	41%
Below Average	26%	14%	10%	15%
Percentage teachers with education level:				
Bachelor's degree	4%	7%	5%	8%
Bachelor's degree + 15 hours or more	59%	64%	50%	44%

Education specialist	0%	4%	0%	0%
Master's degree	11%	4%	20%	10%
Master's degree + 15 hours or more	26%	21%	25%	37%
Number years teaching experience (Median)	18.0	18.5	17.0	19.0

Note. Percentages do not sum to 100 in some cases due to rounding.

Appendix B

Survey Instructions and Forms for Teachers

Demographic Information

1. Your Name _____
2. School Name and Location _____
3. The grade(s) you teach _____
4. Counting this year, how many years have you taught in any school? _____
5. Please check the highest level of formal education you have completed.

   _____ Bachelor's degree

   _____ Bachelor's degree + 15 hours or more

   _____ Educational Specialist

   _____ Master's degree

   _____ Master's degree + 15 hours or more

   _____ Doctorate

   _____ Other (please explain)
6. What is/are your degree(s) in? _____
7. Does your district currently have content standards? _____ yes _____ no
8. Does your state currently have content standards? _____ yes _____ no
9. Check the type of school setting where you teach:

   _____ Urban

   _____ Suburban

   _____ Rural
10. Check the type of school where you teach:

    _____ Public

    _____ Private

    _____ Parochial

    _____ Other (please describe)
11. Approximate school enrollment _____
12. Average class size _____
13. Overall, how would you rate the student achievement of your school?

    _____ Above Average

    _____ Average

    _____ Below Average

Teacher Survey of Standards Instruction
Instructions for Completing Survey

Dear Teacher:

Thank you for participating in the Teacher Survey of Standards Instruction. This survey is part of an ongoing research project regarding a comprehensive set of education standards at the Mid-continent Regional Educational Laboratory (McREL). A current concern in education is the amount of instruction time needed to cover all standards and the need for teachers to prioritize standards and benchmarks. This survey examines the following:

1. How long teachers estimate it takes to teach a standard or benchmark to a class of average students.

2. What standards and benchmarks are most important and appropriate for students at each grade level.

Because there is a limited amount of instructional time throughout the school year, educators must choose what standards to teach and what to ignore. Your responses will help us understand instructional priorities. We have chosen to ask for your responses because classroom teachers are most knowledgeable about their curricula and their students' needs.

Your responses will be confidential. The results of the survey will be reported as an average for all teachers responding at a grade level, and responses of individual teachers will not be presented.

Instructions:

1. The first two forms in this packet are for administrative purposes. Please complete the ***Consultant Agreement Form*** and the ***Consultant Payment Form*** so that we can send a remittance of $25.00 per completed packet to you at the address you provide.

2. The next form in this packet contains questions regarding the demographics of your school and your experience as a teacher. Please complete this ***Demographics Information*** form. Again, your responses will be kept confidential, but please include your name on this form.

3. For each page of the survey, please do the following:

   a. Complete the ***"Estimated time in hours"*** column. Provide a time estimate, in hours, for how long it would take you to teach each standard's benchmarks to a class of average students at the grade level you currently teach. **By this, we mean how much class time would you need to devote to the skill or knowledge contained in the benchmark until a class of average students at the grade level you teach would master that skill or knowledge.**

The amount of time needed to teach a benchmark might be different from the amount of time you actually spend with your class on that skill or concept. Please estimate the amount of instructional time necessary for average students to master the benchmark, without considering the constraints on instructional time such as the need to cover other topics and concepts. That is, make your estimates based on what you know about students' knowledge and abilities at the grade level you teach, and what you know about the difficulty of attaining the benchmark. For benchmarks that you do not teach, we would also like you to provide a reasonable estimate of necessary instruction time using what you know about the content area and students at the grade level you teach.

For example, if it takes one-half hour daily for 4 weeks to instruct students in a skill and for them to master that skill, then your estimate is 10 hours. If the benchmark is already completely mastered by the average student at the grade level you teach, then the amount of time needed to teach that benchmark should be negligible.

b. Fill out the column headed ***"I think this is important for students in this grade to know/do."*** On a four-point scale (where the four choices correspond to Strongly Disagree, Disagree, Agree, and Strongly Agree), indicate the degree to which you agree that a benchmark is important for students at the grade level you teach to know.

c. Fill out the column headed ***"I think this is appropriate for students in this grade to learn."*** On a four-point scale, indicate the degree to which you agree with this statement for each benchmark.

d. In addition to these responses, please feel free to edit the content of the benchmark to what you, as a teacher, believe is appropriate. **Editing the benchmarks is an optional part of this survey.**

Please return this packet to the study's data coordinator at your school or district. If you want to insure confidentiality, you can put this packet in a sealed envelope before returning it. If you wish to mail the completed packet directly to McREL, please mail it to the address provided below. If you have any questions, please phone Sheila Heitzig or Judy Florian at McREL at (303) 337-0990 and refer to the Teacher Survey of Standards Instruction.

Teacher Survey of Standards Instruction, McREL
2550 South Parker Road, Suite 500 Aurora, CO 80014

DIRECTIONS
1. Estimate the **amount of time in hours** it would take to teach this to an average student. Give your best estimate for each benchmark.
2. Indicate **your agreement** with the two statements in columns 2 and 3 using the four-point scale provided. Circle your response.
3. **Edit the benchmark** to reflect what you usually cover during a school year (optional).

Four-point scale: SD - Strongly Disagree D - Disagree A - Agree SA - Strongly Agree

LANGUAGE ARTS

		Estimated time in hours	I think this is important for students in this grade to know/do. (circle one)	I think this appropriate for students in this grade to learn. (circle one)
1.	**Demonstrates competence in the general skills and strategies of the writing process.** • Prewriting: Uses prewriting strategies to plan written work (e.g., discusses ideas with peers, draws pictures to generate ideas, writes key thoughts and questions, rehearses ideas, records reactions and observations)		SD D A SA	SD D A SA
	• Drafting and Revising: Uses strategies to draft and revise written work (e.g., rereads, rearranges words, sentences, and paragraphs to improve or clarify meaning; varies sentence type; adds descriptive words and details; deletes extraneous information; incorporates suggestions from peers and teachers; sharpens the focus)		SD D A SA	SD D A SA
	• Editing and Publishing: Uses strategies to edit and publish written work (e.g., proofreads using a dictionary and other resources; edits for grammar, punctuation, capitalization, and spelling at a developmentally appropriate level; incorporates illustrations or photos; shares finished product)		SD D A SA	SD D A SA
	• Evaluates own and others' writing (e.g., asks questions and makes comments about writing, helps classmates apply grammatical and mechanical conventions)		SD D A SA	SD D A SA
	• Dictates or writes with a logical sequence of events (e.g., includes a beginning, middle, and ending)		SD D A SA	SD D A SA
	• Dictates or writes detailed descriptions of familiar persons, places, objects, or experiences		SD D A SA	SD D A SA
	• Writes in response to literature		SD D A SA	SD D A SA
	• Writes in a variety of formats (e.g., picture books, letters, stories, poems, information pieces)		SD D A SA	SD D A SA
2.	**Demonstrates competence in the stylistic and rhetorical aspects of writing** • Uses general, frequently used words to convey basic ideas		SD D A SA	SD D A SA
3.	**Uses grammatical and mechanical conventions in written compositions** • Forms letters in print and spaces words and sentences		SD D A SA	SD D A SA
	• Uses complete sentences in written compositions		SD D A SA	SD D A SA

Appendix C

Time Estimates to Teach Standards in Four Domains

Table B1. Teachers' Estimates of Instruction Time for Language Arts Standards and Benchmarks

Standard	2nd Grade (N=26)	5th Grade (N=30)	8th Grade (N=9)	12th Grade (N=35)
Writing				
1. Demonstrates competence in the general skills and strategies of the writing process	91.0 (11.4)	110.0 (9.2)	108.0 (8.3)	70.0 (5.4)
2. Demonstrates competence in the stylistic and rhetorical aspects of writing	10.0 (10.0)	17.5 (5.8)	35.0 (8.6)	18.5 (2.3)
3. Uses grammatical and mechanical conventions in written compositions	108.0 (10.8)	84.0 (7.0)	76.0 (6.3)	22.0 (1.8)
4. Gathers and uses information for research purposes	15.0 (7.5)	31.0 (4.4)	39.0 (4.9)	29.0 (2.4)
Reading				
5. Demonstrates competence in the general skills and strategies of the reading process	64.5 (8.1)	48.0 (4.8)	55.0 (7.9)	17.0 (2.4)
6. Demonstrates competence in general skills and strategies for reading a variety of literary texts	67.0 (11.2)	67.0 (6.7)	124.0 (10.3)	42.0 (4.2)
7. Demonstrates competence in the general skills and strategies for reading a variety of informational texts	40.0 (10.0)	40.0 (5.7)	105.0 (11.7)	35.0 (3.5)
Listening and Speaking				
8. Demonstrates competence in speaking and listening as tools for learning	51.0 (5.7)	35.0 (3.2)	66.0 (7.3)	24.5 (2.7)
Total	447.0 (9.3)	432.5 (6.0)	608.0 (8.2)	258.0 (3.2)

Note. Number in parenthesis refers to the average number of hours per benchmark estimated by teachers.

Table B2. Teachers' Estimates of Instruction Time for Civics Standards and Benchmarks

Standard	2nd Grade (N=26)	5th Grade (N=30)	8th Grade (N=6)	12th Grade (N=14)
What is government and what should it do?				
1. Understands ideas about civic life, politics, and government	6.0 (2.0)	23.0 (3.3)	10.0 (2.0)	16.5 (2.1)
2. Understands the essential characteristics of limited and unlimited governments	1.0 (1.0)	9.2 (2.3)	5.0 (2.5)	11.0 (1.8)
3. Understands the sources, purposes, and functions of law and the importance of the rule of law for the protection of individual rights and the common good	9.5 (1.6)	7.0 (3.5)	4.5 (1.5)	4.0 (2.0)
4. Understands the concept of a constitution, the various purposes that constitutions serve, and the conditions that contribute to the establishment and maintenance of constitutional government	NA	NA	12.0 (1.5)	20.0 (2.2)
5. Understands the major characteristics of systems of shared powers and of parliamentary systems	NA	NA	NA	9.5 (3.2)
6. Understands the advantages and disadvantages of federal, confederal, and unitary systems of government	NA	NA	5.0 (1.7)	4.0 (2.0)
7. Understands alternative forms of representation and how they serve the purposes of constitutional government	NA	NA	NA	5.0 (1.3)
What are the basic values and principals of American democracy?				
8. Understands the central ideas of American constitutional government and how this form of government has shaped the character of American society	2.0 (2.0)	30.0 (3.3)	16.0 (2.7)	25.0 (2.5)
9. Understands the importance of Americans sharing and supporting certain values, beliefs, and principles of American constitutional democracy	NA	23.8 (2.9)	9.0 (2.3)	4.0 (1.3)
10. Understands the roles of volunteerism and organized groups in American social and political life	NA	2.0 (2.0)	3.0 (1.0)	8.0 (1.3)
11. Understands the role of diversity in American life and the importance of shared values, political beliefs, and civic beliefs in an increasingly diverse American society	NA	20.0 (2.5)	16.0 (2.3)	17.0 (2.8)
12. Understands the relationships among liberalism, republicanism, and American constitutional democracy	NA	NA	NA	20.0 (1.7)
13. Understands the character of American political and social conflict and factors that tend to prevent or lower its intensity	NA	NA	9.0 (1.8)	8.0 (1.6)
14. Understands issues concerning the disparities between ideals and reality in American political and social life	NA	NA	9.0 (1.8)	5.0 (1.7)

Standard	2nd Grade (N=26)	5th Grade (N=30)	8th Grade (N=6)	12th Grade (N=14)
How does the government established by the constitution embody the purposes, values, and principles of American democracy?				
15. Understands how the United States Constitution grants and distributes power and responsibilities to national and state government and how it seeks to prevent the abuse of power	NA	16.0 (2.7)	11.0 (1.4)	25.0 (2.8)
16. Understands the major responsibilities of the national government for domestic and foreign policy, and understands how government is financed through taxation	NA	NA	9.0 (1.8)	9.5 (1.9)
17. Understands issues concerning the relationship between state and local governments and the national government and issues pertaining to representation at all three levels of government	NA	16.0 (2.3)	9.5 (1.4)	7.5 (1.3)
18. Understands the role and importance of law in the American constitutional system and issues regarding the judicial protection of individual rights	NA	2.0 (2.0)	24.0 (2.2)	16.0 (1.6)
19. Understands what is meant by "the public agenda," how it is set, and how it is influenced by public opinion and the media	NA	NA	8.0 (1.3)	17.0 (2.4)
20. Understands the roles of political parties, campaigns, elections, and associations and groups in American politics	NA	NA	9.0 (1.8)	10.4 (1.3)
21. Understands the formation and implementation of public policy	NA	NA	4.0 (1.3)	6.5 (1.6)
What is the relationship of the United States to other nations and to world affairs?				
22. Understands how the world is organized politically into nation-states, how nation-states interact with one another, and issues surrounding U.S. foreign policy	NA	11.0 (2.8)	21.0 (3.0)	25.0 (2.1)
23. Understands the impact of significant political and nonpolitical developments on the United States and other nations	NA	NA	15.5 (2.6)	20.0 (2.9)
What are the roles of the citizen in American democracy?				
24. Understands the meaning of citizenship in the United States, and knows the requirements for citizenship and naturalization	NA	4.0 (1.3)	7.0 (1.2)	3.0 (1.0)
25. Understands issues regarding personal, political, and economic rights	4.0 (1.3)	8.0 (2.0)	15.0 (2.1)	9.0 (4.5)
26. Understands issues regarding the proper scope and limits of rights and the relationships among personal, political, and economic rights	2.6 (1.3)	3.0 (3.0)	10.0 (2.5)	11.0 (1.6)

Standard	2nd Grade (N=26)	5th Grade (N=30)	8th Grade (N=6)	12th Grade (N=14)
27. Understands how certain character traits enhance citizens' ability to fulfill personal and civic responsibilities	8.0 (2.7)	8.0 (2.0)	11.0 (2.2)	13.0 (1.6)
28. Understands how participation in civic and political life can help citizens attain individual and public goals	NA	6.0 (2.0)	12.0 (2.0)	10.5 (2.1)
29. Understands the importance of political leadership, public service, and a knowledgeable citizenry in American constitutional democracy	3.5 (1.8)	12.5 (2.1)	9.0 (1.1)	6.0 (2.1)
Total	36.6 (1.7)	201.5 (2.7)	273.5 (1.8)	346.4 (1.9)

Note. NA means not applicable; i.e., there are no benchmarks for this age group under this standard.

Table B3. Teachers' Estimates of Instruction Time for Math Standards and Benchmarks

Standard	2nd Grade (N=26)	5th Grade (N=23)	8th Grade (N=14)	12th Grade (N=17)
1. Effectively uses a variety of strategies in the problem-solving process	55.0 (11.0)	48.8 (6.1)	33.0 (3.7)	56.0 (7.0)
2. Understands and applies basic and advanced properties of the concepts of numbers	41.0 (8.2)	39.8 (6.6)	37.5 (5.4)	31.0 (6.2)
3. Uses basic and advanced procedures while performing the processes of computation	59.0 (14.8)	68.0 (8.5)	32.0 (4.0)	33.0 (4.7)
4. Understands and applies basic and advanced properties of the concepts of measurement	44.0 (11.0)	38.0 (5.4)	31.8 (3.5)	14.0 (3.5)
5. Understands and applies basic and advanced properties of the concepts of geometry	20.0 (5.0)	31.0 (4.4)	30.0 (3.8)	47.0 (4.3)
6. Understands and applies basic and advanced concepts of statistics and data analysis	10.0 (5.0)	25.5 (3.6)	29.0 (2.9)	21.0 (2.3)
7. Understands and applies basic and advanced concepts of probability	5.0 (2.5)	11.5 (2.3)	16.0 (3.2)	14.0 (2.3)
8. Understands and applies basic and advanced properties of functions and algebra	11.5 (5.8)	17.0 (2.8)	64.5 (5.9)	75.0 (5.8)
9. Understands the general nature and uses of mathematics	NA	10.0 (5.0)	7.0 (3.5)	18.0 (1.8)
Total	245.5 (8.8)	289.6 (5.2)	280.8 (4.1)	309.0 (4.2)

Note. NA means not applicable; i.e., there are no benchmarks for this age group under this standard.

Table B4. Teachers' Estimates of Instruction Time for Science Standards and Benchmarks

Standard	2nd Grade (N=26)	5th Grade (N=23)	8th Grade (N=12)	12th Grade (N=19)
Earth and Space				
1. Understand basic features of the Earth	10.0 (3.3)	11.5 (1.9)	28.5 (3.2)	8.0 (2.0)
2. Understands basic Earth properties	2.0 (2.0)	14.0 (2.8)	26.0 (3.7)	16.0 (2.7)
3. Understands essential ideas about the composition and structure of the universe and the Earth's place in it	6.0 (3.0)	9.0 (1.8)	17.0 (2.4)	11.0 (2.2)
Life Sciences				
4. Knows about the diversity and unity that characterize life	5.0 (5.0)	6.0 (3.0)	12.0 (3.0)	7.0 (3.5)
5. Understands the genetic basis for the transfer of biological characteristics from one generation to the next	4.0 (2.0)	4.0 (4.0)	11.5 (2.3)	15.0 (3.0)
6. Knows the general structure and functions of cells in organisms	5.0 (5.0)	4.0 (4.0)	15.5 (5.2)	21.0 (3.0)
7. Understands how species depend on one another and on the environment for survival	5.0 (5.0)	8.0 (2.0)	16.0 (2.7)	6.0 (3.0)
8. Understands the cycling of matter and flow of energy through the living environment	5.0 (5.0)	7.0 (3.5)	6.5 (3.3)	10.5 (5.3)
9. Understands the basic concepts of the evolution of species	5.0 (5.0)	2.0 (2.0)	10.0 (3.3)	9.0 (1.8)
Physical Sciences				
10. Understands basic concepts about the structure and properties of matter	7.0 (3.5)	15.0 (3.0)	25.5 (2.5)	43.2 (2.9)
11. Understands energy types, sources, and conversions, and their relationship to heat and temperature	5.0 (1.7)	7.0 (2.3)	22.2 (3.7)	10.5 (1.8)
12. Understands motion and the principles that explain it	9.0 (1.8)	7.5 (1.5)	16.5 (2.8)	12.5 (2.5)
13. Knows the kinds of forces that exist between objects and within atoms	2.0 (1.0)	5.0 (1.7)	5.0 (2.5)	13.0 (1.9)
Nature of Science				
14. Understands the nature of scientific knowledge	5.0 (5.0)	3.0 (3.0)	6.0 (2.0)	5.0 (1.3)
15. Understands the nature of scientific inquiry	10.0 (5.0)	20.5 (2.6)	30.5 (3.8)	21.0 (3.0)
16. Understands the scientific enterprise	5.0 (5.0)	5.0 (1.7)	11.0 (1.8)	6.0 (1.0)
Total	90.0 (3.1)	128.5 (2.3)	259.7 (2.9)	214.7 (1.9)

Appendix D

Teachers' Importance and Appropriateness Judgments of Benchmarks in the Four Academic Domains

Table D1. 5th Grade Language Arts Benchmark Ratings of Importance (N=30)

Rank	Highest Rated Benchmarks	Average Rating
1	Uses conventions of spelling in written compositions (e.g., spells high frequency, commonly misspelled words from appropriate grade-level list; uses a dictionary and other resources to spell words; uses initial consonant substitution to spell related words; uses vowel combinations for correct spelling) (Standard 3, Benchmark j)	3.83
1	Uses conventions of punctuation in written compositions (e.g., uses periods after imperative sentences and in initials, abbreviations, and titles before names; uses commas in dates and addresses and after greetings and closings in a letter; uses apostrophes in contractions and possessive nouns; uses quotation marks around titles and with direct quotations; uses a colon between hour and minutes) (Standard 3, Benchmark l)	3.83
3	Uses conventions of capitalization in written compositions (e.g., titles of people; proper nouns [names of towns, cities, counties, and states; days of week; months of the year; names of streets; names of countries; holidays]; first word of direct quotations; heading, salutation, and closing of a letter) (Standard 3, Benchmark k)	3.77
3	Decodes words not recognized immediately by using phonetic and structural analysis techniques, the syntactic structure in which the word appears, and the semantic context surrounding the word (Standard 5, Benchmark e)	3.77
3	Editing and publishing: Uses strategies to edit and publish written work (e.g., edits for grammar, punctuation, capitalization, and spelling at a developmentally appropriate level; considers page format [paragraphs, margins, indentations, titles]; selects presentation format; incorporates photos, illustrations, charts, and graphs) (Standard 1, Benchmark c)	3.77
	Lowest Rated Benchmarks	
1	Writes in response to literature (e.g., advances judgments; supports judgments with references to the text, other works, other authors, nonprint media, and personal knowledge) (Standard 1, Benchmark k)	3.03
2	Identifies the author's viewpoint in an informational text (Standard 7, Benchmark g)	3.07

Table D1. 5th Grade Language Arts Benchmark Ratings of Importance (N=30)		
4	Knows the defining characteristics of a variety of informational texts (e.g., textbooks, biographical sketches, letters, diaries, directions, procedures, magazines) (Standard 7, Benchmark b)	3.10
4	Writes expressive compositions (e.g., expresses ideas, reflections, and observations; uses an individual, authentic voice; uses narrative strategies, relevant details, and ideas that enable the reader to imagine the world of the event or experience) (Standard 1, Benchmark j)	3.10
5	Identifies the use of nonverbal cues used in conversation (Standard 8, Benchmark j)	3.13

Table D2. 5th Grade Civics Benchmark Ratings of Importance (N=30)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows the basic purposes of government in the United States (e.g., to protect the rights of individuals, to promote the common good) (Standard 1, Benchmark e)	3.59
2	Knows the major things governments do in one's school, community, state, and nation (e.g., make, carry out, and enforce laws; manage conflicts; provide national security) (Standard 1, Benchmark f)	3.57
3	Knows that the government was created by people who had the following beliefs: the government is established by and for the people, the people have the right to choose their representatives, and the people have the right to change their government and the Constitution (Standard 15, Benchmark c)	3.48
4	Knows how specific documents in American history set forth shared values, principles, and beliefs (e.g., Declaration of Independence, United States Constitution and Bill of Rights, Pledge of Allegiance) (Standard 9, Benchmark c)	3.45
5	Knows how fundamental values and principles of American democracy are expressed in documents such as the Declaration of Independence, the Preamble to the United States Constitution, and the Bill of Rights, as well as in American songs, stories, and speeches (Standard 8, Benchmark c)	3.41
5	Knows that Congress passes laws to protect individual rights (e.g., laws protecting freedom of religion and expression, and preventing unfair discrimination) and promote the common good (e.g., laws providing for clean air, national parks, and the defense of the nation) (Standard 15, Benchmark d)	3.41
5	Understands the importance of work as a characteristic of American society (e.g., work is important to a person's independence and self-esteem; work is important to the well-being of the family, community, state, and nation; all honest work is worthy of respect) (Standard 8, Benchmark i)	3.41
Lowest Rated Benchmarks		
1	Knows individuals or groups who monitor and influence the decisions and actions of their local, state, tribal, and national governments (e.g., the media, labor unions, P.T.A., Chamber of Commerce, taxpayer associations, civilian review boards) (Standard 28, Benchmark c)	2.55

Table D2. 5th Grade Civics Benchmark Ratings of Importance (N=30)		
2	Knows criteria necessary for analyzing and evaluating conflicts over privacy (e.g., how and why something is kept secret; possible reasons why it should not be kept secret) (Standard 26, Benchmark a)	2.63
3	Knows how to contact his/her representatives and which levels of government he/she should contact to express his/her opinions or get help on a specific problem (e.g., the environment, crime, stray or wild animals) (Standard 17, Benchmark g)	2.79
4	Understands why it is important for citizens to monitor their local, state, and national governments; and knows ways people can monitor the decisions and actions of their government such as reading about public issues, watching television news programs, discussing public issues, and communicating with public officials (Standard 28, Benchmark a)	2.83
5	Knows ways people can influence the decisions and actions of their government such as voting, taking an active role in interest groups, political parties, and other organizations that attempt to influence public policy and elections; attending meetings of governing agencies (e.g., city council, school board); working in campaigns, circulating and signing petitions; taking part in peaceful demonstrations; and contributing money to political parties, candidates or causes (Standard 28, Benchmark b)	2.90
5	Knows the criteria necessary for evaluating the strengths and weaknesses of candidates in relation to the qualifications required for a particular leadership role (Standard 29, Benchmark f)	2.90

Table D3. 5th Grade Mathematics Benchmark Ratings of Importance (N=24)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Performs basic mental computations (e.g., addition and subtraction of whole numbers) (Standard 3, Benchmark d)	3.96
2	Adds, subtracts, multiplies, and divides whole numbers and decimals (Standard 3, Benchmark a)	3.92
3	Understands the basic meaning of place value (Standard 2, Benchmark d)	3.83
3	Solves real-world problems involving number operations (e.g., computations with dollars and cents) (Standard 3, Benchmark g)	3.83
5	Understands the properties of and the relationships among addition, subtraction, multiplication, and division (e.g., reversing the order of two addends does not change the sum; division is the inverse of multiplication) (Standard 3, Benchmark f)	3.79
Lowest Rated Benchmarks		
1	Uses basic sample spaces (e.g., the set of all possible outcomes) to describe events (Standard 7, Benchmark e)	2.42
2	Understands that statistical predictions are better for describing what proportion of a group will experience something (e.g., what proportion of automobiles will be involved in accidents) rather than which individuals within the group will experience something, and how often events will occur (e.g., how many sunny days will occur over a year) rather than exactly when they will occur (Standard 7, Benchmark d)	2.48
3	Understands that a summary of data should include where the middle is and how much spread there is around it (Standard 6, Benchmark c)	2.63
4	Understands basic valid and invalid arguments (e.g., counter examples, irrelevant approaches) (Standard 1, Benchmark h)	2.79
5	Understands that when predictions are based on what is known about the past, one must assume that conditions stay the same from the past event to the predicted future event (Standard 7, Benchmark c)	2.83

Table D4. 5th Grade Science Benchmark Ratings of Importance (N=24)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows that water can change from one state to another (solid, liquid, gas) through various processes (e.g., freezing, condensation, precipitation, evaporation) (Standard 1, Benchmark a)	3.67
2	Knows that good scientific explanations are based on evidence (observations) and scientific knowledge (Standard 15, Benchmark e)	3.58
3	Uses simple equipment and tools to gather scientific data and extend the senses (e.g., rulers, thermometers, magnifiers, microscopes, calculators) (Standard 15, Benchmark d)	3.54
3	Knows that air is a substance that surrounds us, takes up space, and moves around us as wind (Standard 1, Benchmark d)	3.54
3	Knows that night and day are caused by the Earth's rotation on its axis (Standard 1, Benchmark e)	3.54
3	Knows that the Sun provides the light and heat necessary to maintain the temperature of the Earth (Standard 1, Benchmark f)	3.54
3	Knows different ways in which living things can be grouped (e.g., plants/animals; pets/nonpets; edible plants/nonedible plants) and purposes of different groups (Standard 4, Benchmark a)	3.54
Lowest Rated Benchmarks		
1	Knows that objects can be classified according to their properties (e.g., magnetism, conductivity, density, solubility) (Standard 10, Benchmark a)	2.83
1	Knows that an object's motion can be described by tracing and measuring its position over time (Standard 12, Benchmark c)	2.83
3	Knows that fossils of past life can be compared to one another and to living organisms to observe their similarities and differences (Standard 9, Benchmark a)	2.92
4	Knows that heat is often produced as a byproduct when one form of energy is converted to another form (e.g., heat is produced by mechanical and electrical machines) (Standard 11, Benchmark a)	2.96
4	Knows that electrically charged material pulls on all other materials and can attract or repel other charged materials (Standard 13, Benchmark a)	2.96
4	Knows that scientists review and ask questions about the results of other scientists work (Standard 15, Benchmark g)	2.96

Table D5. 8th Grade Language Arts Benchmark Ratings of Importance (N=9)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Applies reading skills and strategies to a variety of literary passages and texts (e.g., fiction, nonfiction, myths, poems, fantasies, biographies, autobiographies, science fiction, tall tales, supernatural tales) (Standard 6, Benchmark A)	4.00
1	Uses conventions of punctuation in written compositions (e.g., uses exclamation marks after exclamatory sentences and interjections; uses periods in decimals, dollars, and cents; uses commas with nouns of address and after mild interjections; uses quotation marks with poems, songs, and chapters; uses colons in business letter salutations; uses hyphens to divide words between syllables ant the end of a line) (Standard 3, Benchmark K)	4.00
3	Uses paragraph form in writing (e.g., arranges sentences in sequential order, uses supporting and follow-up sentences) (Standard 2, Benchmark B)	3.89
3	Uses simple and compound sentences in written compositions (Standard 3, Benchmark A)	3.89
3	Editing and Publishing: Uses a variety of strategies to edit and publish written work (e.g., eliminates slang; edits for grammar, punctuation, capitalization, and spelling at a developmentally appropriate level; proofreads using reference materials, word processor, and other resources; edits for clarity, word choice, and language usage; uses a word processor to publish written work) (Standard 1, Benchmark C)	3.89
3	Prewriting: Uses a variety of prewriting strategies (e.g., makes outlines, uses published pieces as writing models, constructs critical standards, brainstorms, builds background knowledge) (Standard 1, Benchmark A)	3.89
	Lowest Rated Benchmarks	
1	Understands complex, extended dialogues and how they relate to a story (Standard 6, Benchmark G)	2.78
2	Identifies strategies used by speakers in oral presentations (e.g., persuasive techniques, verbal and nonverbal messages, the use of fact and opinion) (Standard 8, Benchmark G)	2.88
2	Writes compositions that speculate on problems/solutions (e.g., identifies and defines a problem in a way appropriate to the intended audience, describes at least one solution, presents logical and well-supported reasons) (Standard 1, Benchmark K)	2.88
4	Identifies the ways in which language differs across a variety of social situations (Standard 8, Benchmark I)	2.89

Table D5. 8th Grade Language Arts Benchmark Ratings of Importance (N=9)		
5	Summarizes and paraphrases complex, explicit hierarchic structures in informational texts (Standard 7, Benchmark C)	3.00
5	Understands the effects of the author's style on a literary text (e.g., how it elicits an emotional response from the reader) (Standard 6, Benchmark I)	3.00
5	Identifies specific questions of personal importance and seeks to answer them through literature (Standard 6, Benchmark C)	3.00

Table D6. 8th Grade Civics Benchmark Ratings of Importance (N=5)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Understands how the judicial branch can check the powers of the executive and legislative branches by overruling decisions made by lower courts and ruling on the constitutionality of laws made by Congress and the actions of the executive branch (Standard 15, Benchmark E)	3.80
1	Understands how the executive branch can check the powers of the legislative and judicial branches by vetoing laws passed by Congress and nominating members of the federal judiciary (Standard 15, Benchmark D)	3.80
1	Understands how the legislative branch can check the powers of the executive and judicial branches by establishing committees to oversee the executive branch's activities; impeaching the president, other members of the executive branch, and federal judges; overriding presidential vetoes; disapproving presidential appointments; and proposing amendments to the Constitution (Standard 15, Benchmark C)	3.80
1	Understands how the legislative, executive, and judicial branches share power and responsibilities (e.g., each branch has varying degrees of legislative, executive, and judicial powers and responsibilities) (Standard 15, Benchmark B)	3.80
1	Knows the essential ideas of American constitutional government that are expressed in the Declaration of Independence, the Constitution, and other writings (e.g., the Constitution is a higher law that authorizes a government of limited powers; the Preamble to the Constitution states the purposes of government such as to form a more perfect union, establish justice, provide for the common defense, and promote the general welfare) (Standard 8, Benchmark A)	3.80
	Lowest Rated Benchmarks	
1	Understands the process by which citizens can change their state constitution and cite examples of changes (Standard 17, Benchmark D)	2.00
1	Knows major sources of revenue for state and local governments (e.g., property, sales, and income taxes; fees and licenses; taxes on corporations and businesses; borrowing) (Standard 17, Benchmark F)	2.00
1	Knows principal varieties of law (e.g., constitutional, criminal, civil), and understands how the principal varieties of law protect individual rights and promote the common good (Standard 18, Benchmark C)	2.00

Table D6. 8th Grade Civics Benchmark Ratings of Importance (N=5)		
1	Understands criteria for evaluating the strengths and weaknesses of a rule or law by determining if it is understandable (i.e., clearly written with explicit requirements), possible to follow (i.e., does not demand the impossible), fair, well designed to achieve its purposes, and designed to protect individual rights and to promote the common good (Standard 18, Benchmark D)	2.00
1	Understands the advantages and disadvantages of the adversary system and the advantages and disadvantages of alternative means of conflict management (e.g., negotiation, mediation, arbitration, and litigation) (Standard 18, Benchmark I)	2.00
1	Knows that the public agenda consists of those matters that occupy public attention at any particular time (e.g., crime, health care education, child care, environmental protection, drug abuse) (Standard 19, Benchmark A)	2.00
1	Understands the historical and contemporary roles of prominent associations and groups in local, state, and national politics (e.g., historical associations such as abolitionists, suffragists, labor unions, civil rights groups; religious organizations and contemporary associations such as AFL-CIO, National Education Association, Common Cause, Leagues of Women Voters, Greenpeace, National Association for the Advancement of Colored People) (Standard 20, Benchmark D)	2.00

Table D7. 8th Grade Mathematics Benchmark Ratings of Importance (N=14)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Understands the correct order of operations for performing arithmetic computations (Standard 3, Benchmark D)	4.00
2	Solves problems involving perimeter (circumference) and area of various shapes (e.g., parallelograms, triangles, circles) (Standard 4, Benchmark B)	3.93
2	Adds, subtracts, multiplies, and divides whole numbers, fractions, decimals, integers, and rational numbers (Standard 3, Benchmark A)	3.93
2	Understands the concepts of ratio, proportion, and percent and the relationships among them (Standard 2, Benchmark G)	3.93
5	Understands basic number theory concepts (e.g., prime and composite numbers, factors, multiples, odd and even numbers, square numbers, roots, divisibility) (Standard 2, Benchmark D)	3.86
5	Uses a variety of strategies to understand problem-solving situations and processes (e.g., considers different strategies and approaches to a problem, restates problem from various perspectives (Standard 1, Benchmark B)	3.86
Lowest Rated Benchmarks		
1	Understands the basic concept of outliers (Standard 6, Benchmark I)	2.64
2	Understands the concept of tessellation (i.e., a repetitive pattern of polygons that fit together with no gaps or holes) (Standard 5, Benchmark G)	2.71
2	Understands the basic concepts of center and dispersion of data (Standard 6, Benchmark C)	2.71
2	Understands the basic concepts about how samples are chosen (e.g., random samples, bias in sampling procedures, limited samples, sampling error) (Standard 6, Benchmark J)	2.71
5	Understands how predictions are based on data and probabilities (e.g., the difference between predictions based on theoretical probability and experimental probability) (Standard 7, Benchmark C)	2.86

Table D8. 8th Grade Science Benchmark Ratings of Importance (N=12)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows the processes involved in the water cycle (e.g., evaporation, condensation, precipitation, surface run-off, percolation) and their effects on climatic patterns (Standard 1, Benchmark G)	3.83
2	Knows how the tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns (i.e., heat falls more intensely on one part or another of the Earth's surface during its revolution around the Sun) (Standard 1, Benchmark E)	3.64
3	Knows characteristics and movement patterns of the nine planets in our Solar System (e.g., planets differ in size, composition, and surface features; planets move around the Sun in elliptical orbits; some planets have moons, rings of particles, and other satellites orbiting them) (Standard 3, Benchmark B)	3.58
3	Knows characteristics of our Sun and its position in the universe (e.g., the Sun is a medium-sized star; it is the closest star to Earth; it is the central and largest body in the Solar System; it is located at the edge of a disc-shaped galaxy (Standard 3, Benchmark A)	3.58
5	Knows that all scientific ideas are tentative and subject to change and improvement in principle, but for most core ideas in science, there is much experimental and observational confirmation (Standard 14, Benchmark B)	3.50
5	Knows that an experiment must be repeated many times and yield consistent results before the results are accepted as correct (Standard 14, Benchmark A)	3.50
5	Understands that questioning, response to criticism, and open communication are integral to the process of science (e.g., scientists often differ with one another about the interpretation of evidence or theory in areas where there is not a great deal of understanding; scientists acknowledge conflicting interpretations and work towards finding evidence that will resolve the disagreement) (Standard 14, Benchmark C)	3.50
5	Knows that matter is made up of tiny particles called atoms, and different arrangements of atoms into groups compose all substances (Standard 10, Benchmark A)	3.50
5	Knows how land forms are created through a combination of constructive and destructive forces (e.g., constructive forces such as crustal deformation, volcanic eruptions, and deposition of sediment; destructive forces such as weathering and erosion) (Standard 2, Benchmark E)	3.50

Table D8. 8th Grade Science Benchmark Ratings of Importance (N=12)		
	Lowest Rated Benchmarks	
1	Knows factors that influence reaction rates (e.g., types of substances involved, temperature, concentration, surface area) (Standard 10, Benchmark I)	2.33
2	Knows that energy is a property of many substances (e.g., heat energy is in the disorderly motion of molecules and in radiation; chemical energy is in the arrangement of atoms; mechanical energy is in moving bodies or in elastically distorted shapes; electrical energy is in the attraction or repulsion between charges) (Standard 11, Benchmark A)	2.42
2	Knows possible outcomes of scientific investigations (e.g., some may result in new ideas and phenomena for study; some may generate new methods or procedures for an investigation; some may result in the development of new technologies to improve the collection of data; some may lead to new investigations) (Standard 15, Benchmark H)	2.42
4	Knows that an object's motion can be described and represented graphically according to its position, direction of motion, and speed (Standard 12, Benchmark D)	2.50
4	Understands effects of balanced and unbalanced forces on an object's motion (e.g., if more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude; unbalanced forces such as friction will cause changes in the speed or direction on an object's motion) (Standard 12, Benchmark E)	2.50
4	Knows the work of science requires a variety of human abilities, qualities, and habits of mind (e.g., reasoning, insight, energy, skill, creativity, intellectual honesty, tolerance of ambiguity, skepticism, openness to new ideas) (Standard 16, Benchmark B)	2.50
4	Understands ethics associated with scientific study (e.g., potential subjects must be fully informed of the risks and benefits associated with the research and their right to refuse to participate; potential subjects must be fully informed of possible risks to community and property) (Standard 16, Benchmark D)	2.50

Table D9. 12th Grade Language Arts Benchmark Ratings of Importance (N=35)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Writes compositions that fulfill different purposes (e.g., to reflect, to analyze, to persuade) (Standard 1, Benchmark F)	3.71
2	Drafting and revising: Uses a variety of strategies to draft and revise written work (e.g., rethinks content, organization, and style; checks accuracy and depth of information; redrafts for readability and needs of readers; reviews writing to ensure that content and linguistic structures are consistent with purposes) (Standard 1, Benchmark B)	3.69
2	Editing and Publishing: Uses a variety of strategies to edit and publish written work (e.g., rethinks content, organization, and style; checks accuracy and depth of information; redrafts for readability and needs of readers; reviews writing to ensure that content and linguistic structures are consistent with purpose) (Standard 1, Benchmark C)	3.69
4	Writes in response to literature (e.g., suggests an interpretation; recognizes possible ambiguities, nuances, and complexities in a text; interprets passages of a novel in terms of their significance to the novel as a whole; focuses on the theme of a literary work; explains concepts found in literary works) (Standard 1, Benchmark L)	3.65
5	Asks questions as a way to broaden and enrich classroom discussions (Standard 8, Benchmark B)	3.63
5	Uses paragraph form in writing (e.g., arranges paragraphs into a logical progression, uses clincher or closing sentences) (Standard 2, Benchmark B)	3.63
	Lowest Rated Benchmarks	
1	Reorganizes the concepts and details in informational texts in new ways and describes the advantages and disadvantages of the new organization (Standard 7, Benchmark H)	2.39
2	Uses microfiche to gather information for research topics (Standard 4, Benchmark B)	2.43
3	Uses telephone information services found in public libraries to gather information for research topics (Standard 4, Benchmark D)	2.46
4	Uses government publications to gather information for research topics (Standard 4, Benchmark A)	2.69
5	Uses technical terms and notations in writing (Standard 2, Benchmark E)	2.73

Table D10. 12th Grade Civics Benchmark Ratings of Importance (N=14)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Understands how the overall design and specific features of the Constitution prevent the abuse of power by aggregating power at the national, state, and local levels to allow government to be responsive; dispersing power among different levels of government to protect individual rights, promote the common good, and encourage citizen participation; and using a system of checks and balances (e.g., separated institutions with shared powers, provisions for veto and impeachment, federalism, judicial review, the Bill of Rights) (Standard 15, Benchmark A)	3.79
2	Understands the importance of voting as a form of political participation (Standard 28, Benchmark E)	3.77
3	Knows essential political freedoms (e.g., freedom of religion, speech) and economic freedoms (e.g., freedom to enter into contracts, to choose one's own employment), and understands competing ideas about the relationships between the two (e.g., that political freedom is more important than economic freedom, that political and economic freedom are inseparable) (Standard 2, Benchmark E)	3.71
4	Understands why becoming knowledgeable about public affairs and the values and principles of American constitutional democracy, and communicating that knowledge to others are important forms of participation, and understands the argument that constitutional democracy requires the participation of an attentive, knowledgeable, and competent citizenry (Standard 29, Benchmark B)	3.64
4	Knows how the creation of American constitutional government was influenced by the central ideas of the natural rights philosophy (e.g., all persons have the right to life, liberty, property, and the pursuit of happiness; the major purpose of government is to protect those rights) (Standard 8, Benchmark B)	3.64
	Lowest Rated Benchmarks	
1	Knows the general history of liberalism (e.g., ideas of liberalism that emerged in the seventeenth century and developed during the eighteenth-century Enlightenment; relationship between liberalism and the Protestant Reformation and the rise of market economies and free enterprise) (Standard 12, Benchmark B)	2.21
2	Knows the extent of voluntarism in American society compared to other countries (Standard 10, Benchmark C)	2.36

Table D10. 12th Grade Civics Benchmark Ratings of Importance (N=14)		
3	Understands the relative advantages and disadvantages of the various ways power is distributed, shared, and limited in systems of shared powers and parliamentary systems (e.g., in terms of effectiveness, prevention of the abuse of power, responsiveness to popular will, stability, ability to serve the purposes of constitutional government) (Standard 5, Benchmark C)	2.43
3	Understands the argument that economic responsibilities follow from economic rights (Standard 25, Benchmark C)	2.43
3	Understands the relationship between American voluntarism and Americans' ideas about limited government (Standard 10, Benchmark D)	2.43

Table D11. 12th Grade Mathematics Benchmark Ratings of Importance (N=17)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Uses a variety of strategies (e.g., identify a pattern, use equivalent representations) to understand new mathematical content and to develop more efficient solution methods or problem extensions (Standard 1, Benchmark A)	3.59
2	Adds, subtracts, multiplies, divides, and simplifies rational expressions (Standard 3, Benchmark A)	3.53
3	Uses the Pythagorean Theorem and its converse and properties of special right triangles (e.g., 30-60-90 triangle) to solve mathematical and real-world problems (Standard 5, Benchmark B)	3.47
3	Understands various sources of discrepancy between an estimate and a calculated answer (Standard 3, Benchmark C)	3.47
5	Understands the basic concepts of right triangle trigonometry (e.g., basic trigonometric ratios such as sine, cosine, and tangent) (Standard 5, Benchmark G)	3.41
	Lowest Rated Benchmarks	
1	Understands that mathematical systems that appear to be very different may have the same structural underpinnings (e.g., binary multiplication, a series electrical circuit, and the logical operation "and" have the equivalent roles of "0," "off," and "false," as well as of "1," "on," and "true," respectively) (Standard 2, Benchmark C)	2.18
2	Understands the basic properties and uses of polar coordinates (Standard 5, Benchmark I)	2.24
3	Understands sampling distributions, the central limit theorem, and confidence intervals (Standard 6, Benchmark G)	2.29
4	Understands the concept of discrete probability distribution (Standard 7, Benchmark F)	2.35
5	Understands the characteristics and uses of vectors (e.g., representations of velocity and force) (Standard 5, Benchmark D)	2.47
5	Uses basic operations on vectors (e.g., vector addition, scalar multiplication) (Standard 5, Benchmark F)	2.47
5	Understands that in mathematics, as in other sciences, simplicity is one of the highest values; some mathematicians try to identify the smallest set of rules from which many other propositions can be logically derived (Standard 9, Benchmark C)	2.47

Table D12. 12th Grade Science Benchmark Ratings of Importance (N=20)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows features of human genetics (e.g., most of the cells in a human contain two copies of each of 22 chromosomes; in addition, one pair of chromosomes determines sex [XX or XY]; transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair; dominant and recessive traits explain how variations that are hidden in one generation can be expressed in the next) (Standard 5, Benchmark E)	3.84
1	Knows the structures of different types of cell parts (e.g., cell wall; cell membrane; cytoplasm; cell organelles such as the nucleus, chloroplast, mitochondrion, Golgi apparatus, vacuole) and the functions they perform (e.g., transport of materials, storage of genetic information, photosynthesis and respiration, synthesis of new molecules, waste disposal) (Standard 6, Benchmark A)	3.84
3	Understands how elements are arranged in the periodic table, and how this arrangement shows repeating patterns among elements with similar properties (e.g., numbers of protons, neutrons, and electrons; relation between atomic number and atomic mass) (Standard 10, Benchmark A)	3.75
4	Uses technology (e.g., hand tools, measuring instruments, calculators, computers) and mathematics (e.g., measurement, formulas, charts, graphs) to perform accurate scientific investigations and communications (Standard 15, Benchmark D)	3.74
5	Knows that all energy can be considered to be either kinetic energy (energy of motion), potential energy (depends on relative position), or energy contained by a field (electromagnetic waves) (Standard 11, Benchmark B)	3.69
5	Knows the structure of an atom (e.g., negative electrons occupy most of the space in the atom; neutrons and positive protons make up the nucleus of the atom; protons and neutrons are almost two thousand times heavier than an electron; the electric force between the nucleus and electrons holds the atom together (Standard 10, Benchmark E)	3.69

Table D12. 12th Grade Science Benchmark Ratings (N=20)		
Lowest Rated Benchmarks		
1	Understands general concepts related to the theory of special relativity (e.g., in contrast to other moving things, the speed of light is the same for all observers, no matter how they or the light source happen to be moving; nothing can travel faster than the speed of light) (Standard 12, Benchmark D)	2.75
2	Knows a wide range of natural occurrences may be observed to discern patterns when conditions of an investigation cannot be controlled (Standard 15, Benchmark C)	2.78
3	Knows the structures of proteins (e.g., long, usually folded chain molecules made from 20 different types of smaller amino acid molecules that are arranged in different sequences) and the role of proteins in cell function (Standard 6, Benchmark F)	2.79
4	Knows that science and technology are essential social enterprises, but alone they can only indicate what can happen, not what should happen (Standard 16, Benchmark D)	2.81
5	Understands that individuals and teams contribute to science and engineering at different levels of complexity (e.g., an individual may conduct basic field studies; hundreds of people may work together on a major scientific question or technological problem) (Standard 16, Benchmark B)	2.83

Table D13. 5th Grade Language Arts Benchmark Ratings of Appropriateness (N=30)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Drafting and revising: Uses strategies to draft and revise written work (e.g., elaborates on a central idea; writes with attention to voice, audience, word choice, tone, and imagery; uses paragraphs to develop separate ideas) (Standard 1, Benchmark b)	3.77
1	Editing and publishing: Uses strategies to edit and publish written work (e.g., edits for grammar, punctuation, capitalization, and spelling at a developmentally appropriate level; considers page format [paragraphs, margins, indentations, titles]; selects presentation format; incorporates photos, illustrations, charts, and graphs) (Standard 1, Benchmark c)	3.77
3	Prewriting: Uses prewriting strategies to plan written work (e.g., uses graphic organizers, story maps, and webs; groups related ideas; takes notes; brainstorms ideas) (Standard 1, Benchmark a)	3.73
4	Uses conventions of spelling in written compositions (e.g., spells high frequency, commonly misspelled words from appropriate grade-level list; uses a dictionary and other resources to spell words; uses initial consonant substitution to spell related words; uses vowel combinations for correct spelling) (Standard 3, Benchmark j)	3.70
5	Uses conventions of punctuation in written compositions (e.g., uses periods after imperative sentences and in initials, abbreviations, and titles before names; uses commas in dates and addresses and after greetings and closings in a letter; uses apostrophes in contractions and possessive nouns; uses quotation marks around titles and with direct quotations; uses a colon between hour and minutes) (Standard 3, Benchmark l)	3.67
5	Writes expository compositions (e.g., identifies and stays on the topic; develops the topic with simple facts, details, examples, and explanations; excludes extraneous and inappropriate information) (Standard 1, Benchmark g)	3.67
	Lowest Rated Benchmarks	
1	Writes in response to literature (e.g., advances judgments; supports judgments with references to the text, other works, other authors, nonprint media, and personal knowledge) (Standard 1, Benchmark k)	2.97
2	Identifies the use of nonverbal cues used in conversation (Standard 8, Benchmark j)	3.00
2	Identifies the author's viewpoint in an informational text (Standard 7, Benchmark g)	3.00

Table D13. 5th Grade Language Arts Benchmark Ratings of Appropriateness (N=30)		
2	Knows the defining characteristics of a variety of informational texts (e.g., textbooks, biographical sketches, letters, diaries, directions, procedures, magazines) (Standard 7, Benchmark b)	3.00
5	Writes expressive compositions (e.g., expresses ideas, reflections, and observations; uses an individual, authentic voice; uses narrative strategies, relevant details, and ideas that enable the reader to imagine the world of the event or experience) (Standard 1, Benchmark j)	3.03

Table D14. 5th Grade Civics Benchmark Ratings of Appropriateness (N=30)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows the basic purposes of government in the United States (e.g., to protect the rights of individuals, to promote the common good) (Standard 1, Benchmark e)	3.52
2	Knows the major things governments do in one's school, community, state, and nation (e.g., make, carry out, and enforce laws; manage conflicts; provide national security) (Standard 1, Benchmark f)	3.50
3	Knows how specific documents in American history set forth shared values, principles, and beliefs (e.g., Declaration of Independence, United States Constitution and Bill of Rights, Pledge of Allegiance) (Standard 9, Benchmark c)	3.48
3	Knows that the government was created by people who had the following beliefs: the government is established by and for the people, the people have the right to choose their representatives, and the people have the right to change their government and the Constitution (Standard 15, Benchmark c)	3.48
5	Understands that the Constitution is a written document which states that the fundamental purposes of American government are to protect individual rights and promote the common good (Standard 15, Benchmark a)	3.45
5	Knows that Congress passes laws to protect individual rights (e.g., laws protecting freedom of religion and expression, and preventing unfair discrimination) and promote the common good (e.g., laws providing for clean air, national parks, and the defense of the nation) (Standard 15, Benchmark d)	3.45
Lowest Rated Benchmarks		
1	Knows criteria necessary for analyzing and evaluating conflicts over privacy (e.g., how and why something is kept secret; possible reasons why it should not be kept secret) (Standard 26, Benchmark a)	2.53
2	Knows individuals or groups who monitor and influence the decisions and actions of their local, state, tribal, and national governments (e.g., the media, labor unions, P.T.A., Chamber of Commerce, taxpayer associations, civilian review boards) (Standard 28, Benchmark c)	2.55

Table D14. 5th Grade Civics Benchmark Ratings of Appropriateness (N=30)		
3	Understands why it is important for citizens to monitor their local, state, and national governments; and knows ways people can monitor the decisions and actions of their government such as reading about public issues, watching television news programs, discussing public issues, and communicating with public officials (Standard 28, Benchmark a)	2.76
4	Knows how to contact his/her representatives and which levels of government he/she should contact to express his/her opinions or get help on a specific problem (e.g., the environment, crime, stray or wild animals) (Standard 17, Benchmark g)	2.79
5	Knows ways people can influence the decisions and actions of their government such as voting, taking an active role in interest groups, political parties, and other organizations that attempt to influence public policy and elections; attending meetings of governing agencies (e.g., city council, school board); working in campaigns, circulating and signing petitions; taking part in peaceful demonstrations; and contributing money to political parties, candidates or causes (Standard 28, Benchmark b)	2.83

Table D15. 5th Grade Mathematics Benchmark Ratings of Appropriateness (N=24)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Performs basic mental computations (e.g., addition and subtraction of whole numbers) (Standard 3, Benchmark d)	3.88
2	Solves real-world problems involving number operations (e.g., computations with dollars and cents) (Standard 3, Benchmark g)	3.83
3	Adds, subtracts, multiplies, and divides whole numbers and decimals (Standard 3, Benchmark a)	3.79
4	Understands the properties of and the relationships among addition, subtraction, multiplication, and division (e.g., reversing the order of two addends does not change the sum; division is the inverse of multiplication) (Standard 3, Benchmark f)	3.75
4	Uses a variety of strategies to understand problem situations (e.g., discussing with peers, stating problems in own words, modeling problem with diagrams or physical objects, identifying a pattern) (Standard 1, Benchmark a)	3.75
Lowest Rated Benchmarks		
1	Understands that statistical predictions are better for describing what proportion of a group will experience something (e.g., what proportion of automobiles will be involved in accidents) rather than which individuals within the group will experience something, and how often events will occur (e.g., how many sunny days will occur over a year) rather than exactly when they will occur (Standard 7, Benchmark d)	2.30
2	Uses basic sample spaces (e.g., the set of all possible outcomes) to describe events (Standard 7, Benchmark e)	2.42
3	Understands that a summary of data should include where the middle is and how much spread there is around it (Standard 6, Benchmark c)	2.63
4	Understands basic valid and invalid arguments (e.g., counter examples, irrelevant approaches) (Standard 1, Benchmark h)	2.67
5	Understands the basic concept of a sample (e.g., a large sample leads to more reliable information; a small part of something may have unique characteristics but not be an accurate representation of the whole) (Standard 6, Benchmark g)	2.79
5	Understands that when predictions are based on what is known about the past, one must assume that conditions stay the same from the past event to the predicted future event (Standard 7, Benchmark c)	2.79

Table D16. 5th Grade Science Benchmark Ratings of Appropriateness (N=24)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows that water can change from one state to another (solid, liquid, gas) through various processes (e.g., freezing, condensation, precipitation, evaporation) (Standard 1, Benchmark a)	3.63
2	Knows that good scientific explanations are based on evidence (observations) and scientific knowledge (Standard 15, Benchmark e)	3.50
3	Uses simple equipment and tools to gather scientific data and extend the senses (e.g., rulers, thermometers, magnifiers, microscopes, calculators) (Standard 15, Benchmark d)	3.46
4	Knows the organization of simple food chains and food webs (e.g., green plants make their own food with sunlight, water, and air; some animals eat the plants; some animals eat the animals that eat the plants) (Standard 8, Benchmark b)	3.42
5	Knows that air is a substance that surrounds us, takes up space, and moves around us as wind (Standard 1, Benchmark d)	3.38
5	Knows that materials have different states (solid, liquid, gas), and some common materials such as water can be changed from one state to another by heating or cooling (Standard 10, Benchmark d)	3.38
5	Plans and conducts simple investigations (e.g., makes systematic observations, conducts simple experiments to answer questions) (Standard 15, Benchmark c)	3.38
	Lowest Rated Benchmarks	
1	Knows that objects can be classified according to their properties (e.g., magnetism, conductivity, density, solubility) (Standard 10, Benchmark a)	2.88
1	Knows that an object's motion can be described by tracing and measuring its position over time (Standard 12, Benchmark c)	2.88
3	Knows that electrically charged material pulls on all other materials and can attract or repel other charged materials (Standard 13, Benchmark a)	2.91
4	Knows that heat is often produced as a byproduct when one form of energy is converted to another form (e.g., heat is produced by mechanical and electrical machines) (Standard 11, Benchmark a)	2.92
5	Knows that the pitch of a sound depends on the frequency of the vibration producing it (Standard 12, Benchmark a)	2.96
5	Knows that the patterns of stars in the sky stay the same, although they appear to slowly move from east to west across the sky nightly, and different stars can be seen in different seasons (Standard 13, Benchmark b)	2.96

Table D17. 8th Grade Language Arts Benchmark Ratings of Appropriateness (N=9)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Applies reading skills and strategies to a variety of literary passages and texts (e.g., fiction, nonfiction, myths, poems, fantasies, biographies, autobiographies, science fiction, tall tales, supernatural tales) (Standard 6, Benchmark A)	4.00
1	Uses conventions of punctuation in written compositions (e.g., uses exclamation marks after exclamatory sentences and interjections; uses periods in decimals, dollars, and cents; uses commas with nouns of address and after mild interjections; uses quotation marks with poems, songs, and chapters; uses colons in business letter salutations; uses hyphens to divide words between syllables ant the end of a line) (Standard 3, Benchmark K)	4.00
1	Uses paragraph form in writing (e.g., arranges sentences in sequential order, uses supporting and follow-up sentences) (Standard 2, Benchmark B)	4.00
4	Differentiates between fact and opinion in informational texts (Standard 7, Benchmark I)	3.89
4	Editing and Publishing: Uses a variety of strategies to edit and publish written work (e.g., eliminates slang; edits for grammar, punctuation, capitalization, and spelling at a developmentally appropriate level; proofreads using reference materials, word processor, and other resources; edits for clarity, word choice, and language usage; uses a word processor to publish written work) (Standard 1, Benchmark C)	3.89
4	Prewriting: Uses a variety of prewriting strategies (e.g., makes outlines, uses published pieces as writing models, constructs critical standards, brainstorms, builds background knowledge) (Standard 1, Benchmark A)	3.89
4	Uses simple and compound sentences in written compositions (Standard 3, Benchmark A)	3.89
Lowest Rated Benchmarks		
1	Identifies strategies used by speakers in oral presentations (e.g., persuasive techniques, verbal and nonverbal messages, the use of fact and opinion) (Standard 8, Benchmark G)	2.78
2	Understands complex, extended dialogues and how they relate to a story (Standard 6, Benchmark G)	2.88
2	Identifies the ways in which language differs across a variety of social situations (Standard 8, Benchmark I)	2.88
4	Summarizes and paraphrases complex, explicit hierarchic structures in informational texts (Standard 7, Benchmark C)	2.89

Table D17. 8th Grade Language Arts Benchmark Ratings of Appropriateness (N=9)		
5	Identifies specific questions of personal importance and seeks to answer them through literature (Standard 6, Benchmark C)	3.00
5	Writes compositions that speculate on problems/solutions (e.g., identifies and defines a problem in a way appropriate to the intended audience, describes at least one solution, presents logical and well-supported reasons) (Standard 1, Benchmark K)	3.00
5	Uses a variety of strategies to define and extend understanding of word meaning (e.g., applies knowledge of word origins and derivations, analogies, idioms, similes, metaphors) (Standard 5, Benchmark D)	3.00
5	Understands the effects of the author's style on a literary text (e.g., how it elicits an emotional response from the reader) (Standard 6, Benchmark I)	3.00
5	Writes business letters and letters of request and response (e.g., uses business letter format; states purpose of the letter; relates opinions, problems, requests, or compliments; uses precise vocabulary) (Standard 1, Benchmark M)	3.00

Table D18. 8th Grade Civics Benchmark Ratings of Appropriateness (N=5)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Understands how the judicial branch can check the powers of the executive and legislative branches by overruling decisions made by lower courts and ruling on the constitutionality of laws made by Congress and the actions of the executive branch (Standard 15, Benchmark E)	3.80
1	Understands how the executive branch can check the powers of the legislative and judicial branches by vetoing laws passed by Congress and nominating members of the federal judiciary (Standard 15, Benchmark D)	3.80
1	Understands how the legislative branch can check the powers of the executive and judicial branches by establishing committees to oversee the executive branch's activities; impeaching the president, other members of the executive branch, and federal judges; overriding presidential vetoes; disapproving presidential appointments; and proposing amendments to the Constitution (Standard 15, Benchmark C)	3.80
1	Understands how the legislative, executive, and judicial branches share power and responsibilities (e.g., each branch has varying degrees of legislative, executive, and judicial powers and responsibilities) (Standard 15, Benchmark B)	3.80
5	Knows the essential ideas of American constitutional government that are expressed in the Declaration of Independence, the Constitution, and other writings (e.g., the Constitution is a higher law that authorizes a government of limited powers; the Preamble to the Constitution states the purposes of government such as to form a more perfect union, establish justice, provide for the common defense, and promote the general welfare) (Standard 8, Benchmark A)	3.60
	Lowest Rated Benchmarks	
1	Understands the process by which citizens can change their state constitution and cite examples of changes (Standard 17, Benchmark D)	2.00
1	Knows principal varieties of law (e.g., constitutional, criminal, civil), and understands how the principal varieties of law protect individual rights and promote the common good (Standard 18, Benchmark C)	2.00
1	Understands criteria for evaluating the strengths and weaknesses of a rule or law by determining if it is understandable (i.e., clearly written with explicit requirements), possible to follow (i.e., does not demand the impossible), fair, well designed to achieve its purposes, and designed to protect individual rights and to promote the common good (Standard 18, Benchmark D)	2.00

Table D18. 8th Grade Civics Benchmark Ratings of Appropriateness (N=5)		
1	Understands the advantages and disadvantages of the adversary system and the advantages and disadvantages of alternative means of conflict management (e.g., negotiation, mediation, arbitration, and litigation) (Standard 18, Benchmark I)	2.00
5	Knows major uses of tax revenues received by the national government (e.g., direct payments to individuals such as Social Security, Medicaid, Medicare, and Aid to Families with Dependent Children; national defense; interest on the federal debt; interstate highways) (Standard 16, Benchmark E)	2.20
5	Knows major sources of revenue for state and local governments (e.g., property, sales, and income taxes; fees and licenses; taxes on corporations and businesses; borrowing) (Standard 17, Benchmark F)	2.20
5	Understands the historical and contemporary roles of prominent associations and groups in local, state, and national politics (e.g., historical associations such as abolitionists, suffragists, labor unions, civil rights groups; religious organizations and contemporary associations such as AFL-CIO, National Education Association, Common Cause, Leagues of Women Voters, Greenpeace, National Association for the Advancement of Colored People) (Standard 20, Benchmark D)	2.20
5	Understands the importance to individuals and society of such economic rights as the right to acquire, use, transfer, and dispose of property; choose one's work and change employment; join labor unions and professional associations; establish and operate a business; copyright and patent; and enter into lawful contracts (Standard 25, Benchmark F)	2.20
5	Understands basic contemporary issues involving personal, political, and economic rights (e.g., personal rights issues such as dress codes, curfews, sexual harassment; political rights issues such as hate speech, fair trials, free press; economic rights issues such as welfare, minimum wage, health care, equal pay for equal work) (Standard 25, Benchmark G)	2.20
5	Understands the meaning of civic responsibilities as distinguished from personal responsibilities, and understands contemporary issues that involve civic responsibilities (e.g., low voter participation, avoidance of jury duty, failure to be informed about public issues) (Standard 27, Benchmark D)	2.20

Table D19. 8th Grade Mathematics Benchmark Ratings of Appropriateness (N=14)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Understands the correct order of operations for performing arithmetic computations (Standard 3, Benchmark D)	4.00
2	Solves problems involving perimeter (circumference) and area of various shapes (e.g., parallelograms, triangles, circles) (Standard 4, Benchmark B)	3.93
2	Understands the concepts of ratio, proportion, and percent and the relationships among them (Standard 2, Benchmark G)	3.93
4	Understands basic number theory concepts (e.g., prime and composite numbers, factors, multiples, odd and even numbers, square numbers, roots, divisibility) (Standard 2, Benchmark D)	3.86
2	Adds, subtracts, multiplies, and divides whole numbers, fractions, decimals, integers, and rational numbers (Standard 3, Benchmark A)	3.86
Lowest Rated Benchmarks		
1	Understands the basic concept of outliers (Standard 6, Benchmark I)	2.64
2	Understands the basic concepts about how samples are chosen (e.g., random samples, bias in sampling procedures, limited samples, sampling error) (Standard 6, Benchmark J)	2.64
3	Understands the basic concepts of center and dispersion of data (Standard 6, Benchmark C)	2.71
3	Understands how predictions are based on data and probabilities (e.g., the difference between predictions based on theoretical probability and experimental probability) (Standard 7, Benchmark C)	2.71
5	Understands the concept of tessellation (i.e., a repetitive pattern of polygons that fit together with no gaps or holes) (Standard 5, Benchmark G)	2.79

Table D20. 8th Grade Science Benchmark Ratings of Appropriateness (N=12)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows characteristics of our Sun and its position in the universe (e.g., the Sun is a medium-sized star; it is the closest star to Earth; it is the central and largest body in the Solar System; it is located at the edge of a disk-shaped galaxy) (Standard 3, Benchmark A)	3.75
2	Knows how the tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns (i.e., heat falls more intensely on one part or another of the Earth's surface during its revolution around the Sun) (Standard 1, Benchmark E)	3.73
3	Knows characteristics and movement patterns of the nine planets in our Solar System (e.g., planets differ in size, composition, and surface features; planets move around the Sun in elliptical orbits; some planets have moons, rings of particles, and other satellites orbiting them) (Standard 3, Benchmark B)	3.67
3	Knows how land forms are created through a combination of constructive and destructive forces (e.g., constructive forces such as crustal deformation, volcanic eruptions, and deposition of sediment; destructive forces such as weathering and erosion) (Standard 2, Benchmark E)	3.67
3	Knows that the Earth's crust is divided into plates that move at extremely slow rates in response to movements in the mantle (Standard 2, Benchmark D)	3.67
3	Knows processes involved in the rock cycle (e.g., old rocks at the surface gradually weather and form sediments that are buried, then compacted, heated and often recrystallized into new rock; this new rock is eventually brought to the surface by the forces that drive plate motions, and the rock cycle continues) (Standard 2, Benchmark C)	3.67
3	Knows the processes involved in the water cycle (e.g., evaporation, condensation, precipitation, surface run-off, percolation) and their effects on climatic patterns (Standard 1, Benchmark G)	3.67
	Lowest Rated Benchmarks	
1	Understands ethics associated with scientific study (e.g., potential subjects must be fully informed of the risks and benefits associated with the research and their right to refuse to participate; potential subjects must be fully informed of possible risks to community and property) (Standard 16, Benchmark D)	2.33
2	Knows the work of science requires a variety of human abilities, qualities, and habits of mind (e.g., reasoning, insight, energy, skill, creativity, intellectual honesty, tolerance of ambiguity, skepticism, openness to new ideas) (Standard 16, Benchmark B)	2.36
3	Knows factors that influence reaction rates (e.g., types of substances involved, temperature, concentration, surface area) (Standard 10, Benchmark I)	2.42

Table D20. 8th Grade Science Benchmark Ratings of Appropriateness (N=12)		
3	Knows that scientific inquiry includes evaluating results of scientific investigations, experiments, observations, theoretical and mathematical models, and explanations proposed by other scientists (e.g., reviewing experimental procedures, examining evidence, identifying faulty reasoning, identifying statements that go beyond the evidence, suggesting alternative explanations) (Standard 15, Benchmark G)	2.42
3	Knows possible outcomes of scientific investigations (e.g., some may result in new ideas and phenomena for study; some may generate new methods or procedures for an investigation; some may result in the development of new technologies to improve the collection of data; some may lead to new investigations) (Standard 15, Benchmark H)	2.42

Table D21. 12th Grade Language Arts Benchmark Ratings of Appropriateness (N=35)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Writes compositions that fulfill different purposes (e.g., to reflect, to analyze, to persuade) (Standard 1, Benchmark F)	3.73
2	Writes in response to literature (e.g., suggests an interpretation; recognizes possible ambiguities, nuances, and complexities in a text; interprets passages of a novel in terms of their significance to the novel as a whole; focuses on the theme of a literary work; explains concepts found in literary works) (Standard 1, Benchmark L)	3.59
3	Writes expository compositions (e.g., synthesizes and organizes information from first- and second-hand sources, including books, magazines, computer data banks (Standard 1, Benchmark G)	3.55
4	Editing and Publishing: Uses a variety of strategies to edit and publish written work (e.g., rethinks content, organization, and style; checks accuracy and depth of information; redrafts for readability and needs of readers; reviews writing to ensure that content and linguistic structures are consistent with purpose) (Standard 1, Benchmark C)	3.49
5	Writes research papers (e.g., includes a thesis statement; synthesizes information into a logical sequence) (Standard 4, Benchmark K)	3.46
	Lowest Rated Benchmarks	
1	Uses microfiche to gather information for research topics (Standard 4, Benchmark B)	2.29
2	Reorganizes the concepts and details in informational texts in new ways and describes the advantages and disadvantages of the new organization (Standard 7, Benchmark H)	2.31
3	Uses new information from texts to clarify or refine understanding of academic concepts (Standard 7, Benchmark E)	2.61
4	Makes informed judgments about nonprint media (e.g., detects elements of persuasion and appeal in advertisements; recognizes the impact of pace, volume, tone, and images on media consumers) (Standard 8, Benchmark G)	2.62
5	L5C Uses a range of automatic monitoring and self-correction methods (e.g., rereading, slowing down, subvocalizing) (Standard 5, Benchmark C)	2.64

Table D22. 12th Grade Civics Benchmark Ratings of Appropriateness (N=14)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Understands how the overall design and specific features of the Constitution prevent the abuse of power by aggregating power at the national, state, and local levels to allow government to be responsive; dispersing power among different levels of government to protect individual rights, promote the common good, and encourage citizen participation; and using a system of checks and balances (e.g., separated institutions with shared powers, provisions for veto and impeachment, federalism, judicial review, the Bill of Rights) (Standard 15, Benchmark A)	3.86
2	Understands the importance of voting as a form of political participation (Standard 28, Benchmark E)	3.77
2	Knows essential political freedoms (e.g., freedom of religion, speech) and economic freedoms (e.g., freedom to enter into contracts, to choose one's own employment), and understands competing ideas about the relationships between the two (e.g., that political freedom is more important than economic freedom, that political and economic freedom are inseparable) (Standard 2, Benchmark E)	3.77
4	Understands why becoming knowledgeable about public affairs and the values and principles of American constitutional democracy, and communicating that knowledge to others are important forms of participation, and understands the argument that constitutional democracy requires the participation of an attentive, knowledgeable, and competent citizenry (Standard 29, Benchmark B)	3.71
4	Knows major historical events that led to the creation of limited government in the United States (e.g., Magna Carta (1215), common law, and the Bill of Rights (1689) in England; colonial experience, Declaration of Independence (1776), Articles of Confederation (1781), state constitutions and charters, United States Constitution (1787), Bill of Rights (1791) in the United States) (Standard 8, Benchmark A)	3.71
	Lowest Rated Benchmarks	
1	Knows the general history of liberalism (e.g., ideas of liberalism that emerged in the seventeenth century and developed during the eighteenth-century Enlightenment; relationship between liberalism and the Protestant Reformation and the rise of market economies and free enterprise) (Standard 12, Benchmark B)	2.21
2	Understands the relationship between American voluntarism and Americans' ideas about limited government (Standard 10, Benchmark D)	2.36

Table D22. 12th Grade Civics Benchmark Ratings of Appropriateness (N=14)		
3	Understands the argument that economic responsibilities follow from economic rights (Standard 25, Benchmark C)	2.43
3	Knows the extent of voluntarism in American society compared to other countries (Standard 10, Benchmark C)	2.43
5	Understands the relative advantages and disadvantages of the various ways power is distributed, shared, and limited in systems of shared powers and parliamentary systems (e.g., in terms of effectiveness, prevention of the abuse of power, responsiveness to popular will, stability, ability to serve the purposes of constitutional government) (Standard 5, Benchmark C)	2.50
5	Understands how the belief in limited government and the values and principles of the Constitution have influenced American society (e.g., the Constitution has encouraged Americans to engage in commercial and other productive activities) (Standard 8, Benchmark H)	2.50
5	Understands the relationship between political rights and the economic right to acquire, use, transfer, and dispose of property (Standard 26, Benchmark F)	2.50

Table D23. 12th Grade Mathematics Benchmark Ratings of Appropriateness (N=17)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Uses a variety of strategies (e.g., identify a pattern, use equivalent representations) to understand new mathematical content and to develop more efficient solution methods or problem extensions (Standard 1, Benchmark A)	3.59
2	Understands the basic concepts of right triangle trigonometry (e.g., basic trigonometric ratios such as sine, cosine, and tangent) (Standard 5, Benchmark G)	3.53
2	Uses the Pythagorean Theorem and its converse and properties of special right triangles (e.g., 30-60-90 triangle) to solve mathematical and real-world problems (Standard 5, Benchmark B)	3.53
4	Adds, subtracts, multiplies, divides, and simplifies rational expressions (Standard 3, Benchmark A)	3.47
5	Constructs logical verifications or counter examples to test conjectures and to justify algorithms and solutions to problems (i.e., uses deductive reasoning) (Standard 1, Benchmark D)	3.44
Lowest Rated Benchmarks		
1	Understands that mathematical systems that appear to be very different may have the same structural underpinnings (e.g., binary multiplication, a series electrical circuit, and the logical operation "and" have the equivalent roles of "0," "off," and "false," as well as of "1," "on," and "true," respectively) (Standard 2, Benchmark C)	2.24
2	Understands sampling distributions, the central limit theorem, and confidence intervals (Standard 6, Benchmark G)	2.41
2	Understands the concept of discrete probability distribution (Standard 7, Benchmark F)	2.41
4	Understands different methods of curve-fitting (e.g., the difference between a "true" correlation and a "believable" correlation; when two variables are correlated) (Standard 6, Benchmark D)	2.47
4	Understands the basic properties and uses of polar coordinates (Standard 5, Benchmark I)	2.47

Table D24. 12th Grade Science Benchmark Ratings of Appropriateness (N=20)		
Rank	**Highest Rated Benchmarks**	**Average Rating**
1	Knows the structures of different types of cell parts (e.g., cell wall; cell membrane; cytoplasm; cell organelles such as the nucleus, chloroplast, mitochondrion, Golgi apparatus, vacuole) and the functions they perform (e.g., transport of materials, storage of genetic information, photosynthesis and respiration, synthesis of new molecules, waste disposal) (Standard 6, Benchmark A)	3.68
2	Knows features of human genetics (e.g., most of the cells in a human contain two copies of each of 22 chromosomes; in addition, one pair of chromosomes determines sex [XX or XY]; transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair; dominant and recessive traits explain how variations that are hidden in one generation can be expressed in the next) (Standard 5, Benchmark E)	3.65
3	Uses technology (e.g., hand tools, measuring instruments, calculators, computers) and mathematics (e.g., measurement, formulas, charts, graphs) to perform accurate scientific investigations and communications (Standard 15, Benchmark D)	3.63
4	Understands how the processes of photosynthesis and respiration in plants transfer energy from the Sun to living systems (e.g., chloroplasts in plant cells use energy from sunlight to combine molecules of carbon dioxide and water into complex, energy-rich organic compounds, and release oxygen to the environment) (Standard 8, Benchmark C)	3.60
5	Knows that laws of motion can be used to determine the effects of forces on the motion of objects (e.g., objects change their motion only when a net force is applied; whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object; the magnitude of the change in motion can be calculated using the relationship F=ma, which is independent of the nature of the force) (Standard 12, Benchmark E)	3.59
5	Understands how elements are arranged in the periodic table, and how this arrangement shows repeating patterns among elements with similar properties (e.g., numbers of protons, neutrons, and electrons; relation between atomic number and atomic mass) (Standard 10, Benchmark A)	3.59
5	Knows that all energy can be considered to be either kinetic energy (energy of motion), potential energy (depends on relative position), or energy contained by a field (electromagnetic waves) (Standard 11, Benchmark B)	3.59

Table D24. 12th Grade Science Benchmark Ratings (N=20)		
Lowest Rated Benchmarks		
1	Knows the structures of proteins (e.g., long, usually folded chain molecules made from 20 different types of smaller amino acid molecules that are arranged in different sequences) and the role of proteins in cell function (Standard 6, Benchmark F)	2.75
2	Knows how winds and ocean currents are produced on the Earth's surface (e.g., effects of unequal heating of the Earth's land masses, oceans, and air by the Sun; effects of gravitational forces acting on layers of different temperatures and densities in the oceans and air; effects of the rotation of the Earth) (Standard 1, Benchmark C)	2.79
3	Understands that individuals and teams contribute to science and engineering at different levels of complexity (e.g., an individual may conduct basic field studies; hundreds of people may work together on a major scientific question or technological problem) (Standard 16, Benchmark B)	2.84
4	Knows the history of the origin and evolution of life on Earth (e.g., life on Earth is thought to have begun 3.5-4 billion years ago as simple, one-celled organisms; during the first two billion years, only microorganisms existed; after cells with nuclei developed about a billion years ago, increasingly complex multicellular organisms evolved) (Standard 9, Benchmark E)	2.85
5	Knows how cell functions are regulated through changes in the activity of the functions performed by proteins and through the selective expression of individual genes, and how this regulation allows cells to respond to their environment and to control and coordinate cell growth and division (Standard 6, Benchmark D)	2.90

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